Defining the coupled effects of cryogenic, space-radiation, and hypervelocity impact damamge on COPV's, Phase I

Completed Technology Project (2006 - 2006)

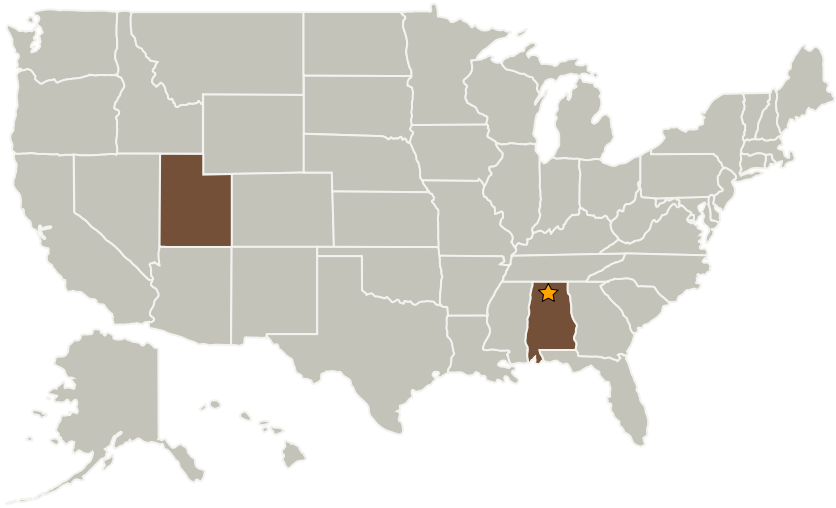
Project Introduction

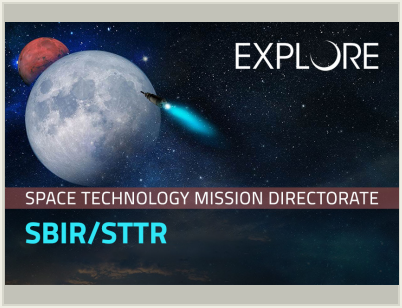
The objective of the research proposed herein is to define the coupled (combined) effect of critical environments on the structural performance of composite overwrap pressure vessels (COPV). The three environments that will be coupled are cryogenic temperature, space irradiation, and hypervelocity (micrometeoroid/space debris) impact. HyPerComp Engineering (HEI) have previously conducted research that studied the independent effects of the three environments on COPV structural performance. Prior research determined that COPV structural performance and capabilities were significantly degraded by each of the environments. Clearly, a space-based cryogenic fuel storage vessel would be exposed to all three environments simultaneously. Therefore, it is of interest to study the coupled effects of the environments, determine the coupled effect, and define design allowables that consider the simultaneous effect. The result will be a safer and more reliable COPV design. Note, the research proposed herein is applicable any space-based composite structure and earth-based COPV

Anticipated Benefits

POTENTIAL COMMERCIAL APPLICATIONS 1. LH2 fuel cell applications. 2. Automotive and marine CNG fuel storage. 3. Marine transport of propane, methane, et al. 4. Environmentally-friendly earth-based cryogenic fluid storage. 5. Safer and more reliable earth-based cryogenic fluid storage.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
HyPerComp Engineering, Inc.	Supporting Organization	Industry	Brigham City, Utah

Primary U.S. Work Locations	
Alabama	Utah

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

Lauren Johnson

Principal Investigator:

Wayne Clark

Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.1 Cryogenic Systems
    - TX14.1.1 In-space Propellant Storage & Utilization